DOCUMENT RESUME

ED 038 233 RC 004 263

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TITLE	The Effects of a Token Reinforcement System on the Reading and Arithmetic Skills Learnings of Migrant Primary School Pupils.
INSTITUTION	New York State Univ., Genescc. Coll. of Arts and Science.
PUB DATE	[68]
NOTE	11p.
EDRS PRICE	EDRS Price MF-$0.25 HC-$0.65
DESCRIPTORS	Anglo Americans, *Arithmetic, Educational Psychology, Learning, *Migrant Children, Negroes, Post Testing, Pretesting, *Primary Grades, *Reading Skills, Reinforcers, Response Mode, *Rewards, Statistical Analysis, Summer Schools, Testing
IDENTIFIERS	New York State

ABSTRACT

The New York State Center for Migrant Studies conducted this 1968 study which investigated effects of token reinforcers on reading and arithmetic skills learnings of migrant primary school students during a 6-week summer school session. Students (Negro and Caucasian) received plastic tokens to reward skills learning responses. Tokens were traded for candy, toys, or sundries to provide supplementary reinforcement. Treatment groups (n=30) were compared with non-treatment groups (n=30) by means of a t-test using scores of the Wide Range Achievement Test. Pretest and posttest comparisons favored the treatment group at the .05 level. Four tables give data relative to the study. (AN)

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THE EFFECTS OF A TOKEN REINFORCEMENT SYSTEM ON THE READING AND ARITHMETIC SKILLS LEARNINGS OF MIGRANT PRIMARY SCHOOL PUPILS[1,2]

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[1968]

ABSTRACT

This study investigated the effects of token reinforcers with back-ups on the reading and arithmetic skills learnings of migrant primary school pupils. Pupils received plastic tokens to reward skills learning responses. Tokens were traded as legal tender to provide supplementary reinforcement. Treatment groups (N = 30) were compared with non-treatment groups (N = 30) by means of a t-test using the Wide Range Achievement Test as criterion. Pretest-posttest comparisons favored the treatment group at the .05 level.

INTRODUCTION

The significant effect of tokens as immediate and supplementary reinforcers of reading behavior in single subjects has been adequately demonstrated by several investigators. (4,5,6,)

The use of tokens as immediate and supplementary reinforcers to increase reading and arithmetic skills learnings during group instruction in classroom settings has not been fully explored. Martin, et al (2) employed a token reinforcement system whereby desirable student behaviors deemed necessary to success in reading classes were reinforced by points registered on a chart and backed-up with grades, letters of commendation, and activities. Although findings indicated significant differences in general classroom behaviors between experimental and control classes, no differences in reading improvement were observed.

The purpose of this investigation was to test the effects of a token reinforcement system on the arithmetic and reading skills

RC004263

acquisition of migrant primary school pupils during a six week summer school session.

HYPOTHESIS

Pupils instructed with tokens as immediate and supplementary reinforcers will demonstrate greater reading and arithmetic gains than pupils instructed without tokens as reinforcers.

PROCEDURE

Subjects: S's for this experiment were Negro migrant and Caucasian primary school pupils registered in six week summer school program conducted by the Sodus Central School, Sodus, New York. At the outset of the experiment 80 pupils were designated as possible treatment pupils and 58 as non-treatment pupils. Pupils were assigned to classes by school administrative procedures. Some pupils matriculated late and others left the program early, as a result pretest and posttest data were available for 60 pupils, 30 in the treatment and 30 in the non-treatment group. Chronological ages for the treatment group ranged from 80 to 114 months, M = 91.97, S.D. = 7.95; non-treatment group ages ranged from 69 to 138 months, M = 98.90, S.D. = 17.01.

Teachers: Treatment group teacher participation was voluntary. Non-treatment group teachers merely submitted pretest and posttest data at the termination of the program. Treatment group teachers met three times at the beginning of the experiment. Discussions focused on what behaviors to reinforce and general procedures.

Methodology: Reading and arithmetic skills learning behaviors were reinforced in particular as were any social behaviors that teachers

deemed necessary to facilitate skills learnings. Such behaviors as attending to a task or listening attentively to the teacher were considered appropriate behaviors to reinforce.

Teachers were urged to follow four principles when dispensing tokens: 1)The behavior required to earn tokens must be in the repertory of the pupil. The task must not be set at a level of difficulty that would make reinforcement unobtainable. Instructional adjustments for individual pupils will be needed to make token earning possible for all pupils. 2)Tokens should be dispensed only on the occurrence of specified behaviors. 3)Tokens should be dispensed as soon after the occurrence of the specified behavior as possible. 4)Tokens must be exchanged for back-up reinforcers.

Pupils deposited tokens in baby food jar banks until they were permitted to exchange them for back-up reinforcers which were stored in a centrally located stock room. An exchange schedule for supplementary reinforcement was not specifically established. Some teachers permitted pupils to trade their tokens daily, others held the pupils to a weekly or semi-weekly schedule.

The introduction of token reinforcement with back-ups was the only modification of the planned summer program. Teachers were encouraged not to deviate from their regular planning or instructional procedures.

Reinforcers and Back-ups: Tokens consisted of red, transparent bingo markers, 1.5 centimeters in diameter and 0.1 centimeter in thickness, purchased at a Five and Ten store. The approximate exchange value was

one-third of a cent per token although this base was not maintained. The value for ten cent toys changed to 2/3 of a cent per token.

Supplementary reinforcement was supplied by the exchange of tokens for a variety of consumable and durable objects. Total expenditure for these back-up reinforcers was $53.67 during the entire program. Table 1 lists the back-up reinforcers with the token value assigned to each object.

Table 1. --Back-up reinforcers and token values.

Candy	Toys		Sundries
1 Token	3 Tokens		7 Tokens
Gum balls	Balloons		Erasers
			Pencils
3 Tokens	4 Tokens		
Bubble gum	Plastic charms		15 Tokens
Candy lozenges			Pencil sharpeners
Suckers	15 Tokens		Scissors
Tootsie Rolls	Balloons	Mouth organ	Tablets
Turkish Taffy	Cars	Planes	
	Coloring books	Play money	30 Tokens
6 Tokens	Compasses	Puzzles	Combs
Sugar Daddys	Creepy crawlers	Rings	
	Flutes	Tanks	45 Tokens
15 Tokens	Jacks	Tops	Materials
Necco Wafers	Jump ropes	Whistles	Weave a potholder
Licorice	Magnets	Yo-Yos	
	Marbles		

RESULTS

The hypothesis proposed was $M_t > M_{nt}$ to be determined ty t-test. The hypothesis was tested by comparing raw score differences between a pretest, and posttest administration of the Wide Range Achievement Test.(1) An alpha level of .05 was established at the outset of experimentation. The t-test for significance of difference between the means for reading and for airthmetic are presented in Table 2. Because the differences

were significant the hypothesis was accepted at the .05 level. When an estimate ω^2 test was conducted for reading and arithmetic the treatment accounted for 8 percent of the variance of the obtained scores for reading and 25 percent of the variance of the obtained scores for airthmetic.

Table 2. --A comparison of Treatment and Non-Treatment Reading and Arithmetic WRAT pretest and posttest score differences

Skill	Group	N	M	SD	t	est.ω^2*	df
Reading	Treatment	30	5.867	4.329	2.504	.081	58
	Non-Treatment	30	1.500	8.521			
Arithmetic	Treatment	30	3.633	2.371	4.550	.247	58
	Non-Treatment	30	0.233	3.339			

$t = 1.684$, $P < .05$; one-tailed
$t = 2.021$, $P < .05$; two-tailed

$$\text{est.}\omega^2 = \frac{t^2 - 1}{t^2 + N_1 + N_2 - 1}.$$

DISCUSSION

Reactions to the treatment were solicited from the five teachers participating by interview at the termination of the program. The following represents the questions and consensus of answers given during those interviews.

Ques: Do you think this summer program has been effective?
Ans: a)Yes - All of the teachers responded in the affirmative. They all felt that the program had resulted in decided pupil effects.

Ques: What weaknesses, if any, did you observe in the program?
Ans: a)Need more intrinsic reinforcement -"learning for learnings sake". b)It seemed easier to reinforce arithmetic than to reinforce other skills. c)Will there be a "carry over" to fall? What will happen when the token system is withdrawn? d)Need to use other ways to reinforce more kinds of behavior.

Ques: What behavior did you reinforce during the summer program?
Ans: a)Social behavior (all teachers), b)Arithmetic, c)Language Arts, and types of specific behaviors that would fall into the broad language arts category, including discrimination (auditory and visual), that would lead to larger language response units.

Ques: Did you reinforce any particular behavior more than another?
Ans: a)Arithmetic, b)Social behavior, c)Matching letter and beginning sounds.

Ques: Did you find the back-up reinforcers satisfactory?
Ans: a)Need less candy and more school type ("learning") materials, and toys.

Ques: Did the use of token reinforcement help indicate needed instructional adjustments? (Indicate if the task was too easy or too difficult?)
Ans: a)Three teachers answered in the affirmative. b)Two responded in the affirmative with qualifications that classload must be small and most teachers should have some ideas about task difficulty.

Ques: Will you incorporate token reinforcement methods into your classroom teaching?
Ans: a)One teacher responded "Yes". b)Two teachers responded in the affirmative with qualifications that if they had slow learners or culturally deprived pupils then a token reinforcement system would be effective with these groups.
c)One teacher would prefer to use charts and stars.
c)One teacher thought it was a possibility if it facilitated learning.

In general, teachers seemed to have a positive attitude toward the program and were convinced of its effectiveness at termination. This was not the case at the outset of the summer session, although teachers were volunteers, they were skeptical as to the ultimate effectiveness of the program and exhibited concern over the ethics of "bribing children" and "giving constant rewards for school work". At termination some observed that the program was effective but perhaps, most effective with slow learners and culturally deprived pupils.

Programs and the behaviors reinforced were variable. All teachers reinforced social behavior at the outset of the program and

gradually worked into reinforcing skills learning behavior. The teachers found arithmetic akills easier to reinforce. Note that the est.ω^2 for arithmetic accounted for 25 percent of the variance from treatment to the dependent variable.

This investigator made inquiries in mid-November following the summer session to determine if teachers were employing token reinforcement techniques during the regular school session. It was found that one teacher intended to incorporate some type of token reinforcement system into his regular teaching but to date had not instituted such a program.

When the number of tokens dispensed throughout the course of the program (N = 7,213) was totaled for each of three treatment classes examined in testing the foregoing hypothesis, it was noted that there was considerable variance between classes when the mean number of tokens dispensed per pupil was considered.

Were these variations significant in relation to treatment gains for each class?

Table 3 presents the results of the Kruskal-Wallis One Way Analysis of Variance when groups were considered on the basis of the mean number of tokens received per pupil.

Table 3. --Kruskal-Wallis One Way analysis of Variance of raw score differences for high, medium and low token reinforcement recipient groups.

Group	N	M*	H**
High	7	190.3	Reading H = 8.923, P $<$ .02, df = 2
Medium	10	133.1	
Low	13	78.6	Arithmetic H = 7.279, P $<$ .05, df = 2

*Mean number of tokens dispensed per pupil.
**The probability of the statistic H is determined from a table of critical values of Chi Square.

The hypothesis that observed differences among groups might be ascribed to the mean number of tokens dispensed per pupil was tested for both reading and arithmetic skills. When the null hypothesis was tested by Kruskal-Wallis H - test. The H_o was rejected for the reading skill at the .02 level. The H_o was rejected for the arithmetic skill at the .05 level.

These findings (significant differences for both skills at the .05 level) can be interpreted to mean that observed differences among groups could have been influenced by the mean number of tokens dispensed per pupil. Such findings support the principal hypothesis that learning is significantly effected by use of token reinforcers, but the findings also introduce the dimensions of relative frequency of reinforcement and relative effectiveness as reinforcers of different skills. These dimensions should be investigated further.

Were differences observed when Treatment and Non-Treatment groups were examined on the basis of race?

Three comparisons were made for each skill using a t-test. The following table presents the significant differences observed at the .05 level. Interpretation of these findings are considered highly tentative, however, the possibility can be accepted that some factor associated with race may be a source of significant variation in the effects of token reinforcement.

Table 4. -- Significant t values of raw score differences on pretest and posttest WRAT - Treatment vs Non-Treatment - Negro vs Caucasian

Group	N	t*	df
Reading			
Negro Treatment	18		
≠		2.5319	28
Caucasian Treatment	12		
Negro Treatment	18		
≠		2.8459	30
Negro Non-Treatment	14		
Negro Non-Treatment	14		
≠		2.6520	28
Caucasian Non-Treatment	16		
Arithmetic			
Negro Treatment	18		
≠		2.2574	28
Negro Non-Treatment	14		
Caucasian Treatment	12		
≠		2.6627	24
Negro Non-Treatment	14		
Caucasian Treatment	12		
≠		2.3317	26
Caucasian Non-Treatment	16		

*P < .05, two-tailed tests.

IMPLICATIONS FOR PRACTICE

The use of token reinforcers with back-ups has a decided effect on the modification of social and skills learning behavior. The introduction of such a system into a classroom setting can be accomplished with minimal monetary expenditure and teacher orientation.

Participating treatment teachers expressed opinions that the treatment programs would have greater effects on culturally disadvantaged (Negro) pupils. The observed population differences in Table 4, are considered speculative and not a decided finding. The experiment was not

designed to detect these differences or the differences observed in relationship to the number of tokens dispensed per pupil.

Back-up reinforcers need not center around toys, candy and sundries but, could consist of activities, school supplies, pupil specified privileges, and activities. For instance, Premack (3) has suggested that high probability behavior can be used to reinforce low probability behavior. The teacher need only observe or be knowledgeable of high probability behavior and use it to reinforce low probability behavior. It could be stated in the following terms "Execute some amount of low probability behavior then you may immediately engage in some high probability behavior for a specified time".

The employment of a token reinforcement system has some subtle positive effects on the total classroom program. First, it could make the teacher more cognizant of individual behavior. One must carefully examine behavioral repertories of individuals if one is going to reinforce and modify them. Under these circumstances the teacher is forced into the position of individualizing instruction. Second, it can become an instructional monitoring system. It provides the teacher with a method of analyzing the task and making the necessary instructional adjustments. If a pupil is receiving no or few tokens the task is too difficult. On the other hand, if the pupil is receiving too many tokens the task may be too easy. Third, it may provide the teacher with some ideas about the powerful effects of reinforcement and encourage a more careful and deliberate handling of pupil response.

The possibility that there were differing pupil effects when the variables of mean number of tokens dispensed per pupil and race

were considered is speculation and should not be treated as a finding. These variables might merit investigation under more carefully controlled conditions.

FOOTNOTES

1. This study was funded by the New York State Center for Migrant Studies, State University College of Arts and Science at Geneseo, Geneseo, New York.

2. The investigator wishes to thank Dr. Richard L. Stolper, Chairman of the Department of Educational Administration, Research and Foundations, State University College of Arts and Science at Geneseo, for his scholarly editorial assistance and criticism in the preparation of this and many previous manuscripts.

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